Proceedings of the 34th Accra Bespoke Multidisciplinary Innovations Conference & the Africa AI Stakeholders Summit
Academic City University College, Accra Ghana
19th – 21st December, 2022
www.isteams.net/accrabespoke2022

Impacts of Internet of Things (Iot) and 5G Network on Technology Enhanced Learning (Tel)

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ABSTRACT

Thanks to the express rise of digitalization, Artificial Intelligence, and Android Communication Technologies, the internet has gradually encroached into many aspects of our daily lives dependenton the maintenance of the status quo. In the era of digital technology, it has grown into a significantfield that is closely related to the future of the nation. For instance, the Internet has permeated every classroom, every dorm, and every college student's daily study routine. College students have emerged as the Internet's most aggressive adopters of new technologies. This will help more swiftly identify the effects of teaching and learning. Roles and permissions for users can also be managed by it. This kind of integrated "network online course" is one that colleges and universities are implementing more frequently. The range, timeliness, interaction, and breadth of the computer network can enhance traditional education and provide ideological and intellectual education in colleges and universities a new lease on life. Classroom management and lesson plans go hand in hand for any improved and effective learning. However, the proliferation of the IoT and the 5G network had a significant negative influence on this improvement in many ways. This paper examined the Impacts of Internet of Things (Iot) and 5G Network on Technology Enhanced Learning (Tel) and make reccomendations to mitigate problematic impacts

Keywords: Internet Of Things (Iot), 5G Network, Technology Enhanced Learning (Tel)

Proceedings Reference Format
Dabo, A.M., Sarki, A.M. , Fapohunda, S.E. & Longe, E.O. (2022): Impacts of Internet of Things (Iot) and 5G Network on Technology Enhanced Learning (Tel). Proceedings of the 34th Accra Bespoke Multidisciplinary Innovations Conference & The Africa AI Stakeholders Summit. Academic City University College, Accra Ghana, 2022.
Pp 175-192. www.isteams.net/accrabespoke2022. https://doi.org/10.22624/AIMS/ACCRABESPOKE2022/V34P14

1. INTRODUCTION & BACKGROUND TO THE STUDY

Through modern media, university graduates gain a significant quantity of knowledge and information, which has an impact on their strategy of living, studying, and reasoning. Students' ideologies in research andeducation broaden and bring up new opportunities while also raising

serious issues (Yu 2021). The fact that information is abundant and is being transmitted and updated at an increasing rate is oneof the traits of modern civilization. In these circumstances, the emphasis should be on changing traditional ideological and intellectual education to simply explain and introduce basic theory inculcating model, effective use of network advantage, various theories and messages swiftly passed on to ideological and political education of the educated, faster and better to implant educated spirit of independent learning, so they can improve their ideologies.

Teachers can develop multimedia curricula tailored to individual courses and submit them for online digital lectures. Graduates can learn at any time by browsing the internet; if they don't understand something, they can post a message on a BBS in SMS or voice that is not in real time if they do not. Digital exams are also feasible in digital learning, with professors being able to releasepertinent exercises online and students being able to practice and keep track of their progress.

The Internet of Things (IoT) is a network of physical objects likecars, appliances, and other household items that are equipped with electronics, software, sensors, actuators, and connectivity. By connecting to one another and exchanging data, these objects can more directly integrate with computer-based systems, leading to increased productivity, financialgains, and decreased labor requirements. In 2017, there were 8.4 billion IoT devices, up 31% fromthe previous year. It is predicted that there will be 30 billion devices by 2020. By 2020, it is anticipated that the IoT market would be worth $7.1 trillion globally (Hlaing et al, 2019). It entails extending Internet connectivity to a variety of conventionally unconnected or non-internet-enabledphysical objects and everyday items, in addition to ordinary devices like desktops, laptops, smartphones, and tablets. These gadgets have technology built into them, so they can interact andcommunicate online and be monitored and controlled from a distance. A subset of IoT called the Internet of Vehicles is beginning to receive greater attention with the advent of driverless cars (Hlaing et al, 2019).

The Internet of Things (IoT) offers enormous educational prospects by combining independent control with enhanced infrastructure provision for higher education institutions. With the help of the Internet of Things, people and objects can connect to anyone and anything from anywhere at any time, without the need for a particular path or service (Villa-Henriksen et al., 2020). Additionally, the IoT increases procedures and disseminates online education to pupils (Al-Emranet al., 2020). Additionally, the IoT reduces costs and enables students to attend lessons whenever they want, whether on campus, at home, or even on public transportation. Consequently, it is anticipated that the IoT will provide solutions that will change how teaching and learning are done.The Internet of Things is a recent player in educational settings.

It is crucial for fostering interaction, better learning, and understanding between academic staff and students in the tertiaryeducation setting through virtual and actual items. Additionally, there is a greater emphasis on smart education and the use of IoT technologies to benefit students in a class. As a result, academics and researchers are increasingly evaluating the deployment of IoT due to the rise in theuse of online learning by institutions (Kassab et al., 2020). The Internet of Things enables changes in the teaching, learning, management, experimentation,

training, school, campus building, and other environments of tertiary, secondary, and elementary institutions in education.
This opens up a new opportunity where cutting-edge learning possibilitiesemerge as a result of the conceptual shift brought about by ubiquitous computing and technologies.The Ministry of Higher Education Strategic Plan 2013-2020 mandates that the education sector contribute to, advance, and harmonize high-quality education, training, and research in developingcountries. The relationship between Mobile Communication Technology and the Internet of Things has grownfurther with the advent of the 5G era. The two can be effectively combined to both advance scienceand technology and improve peoples' lives. The creation of smart campuses is of tremendous significance and has become an unavoidable trend in the development of colleges and universities, whether it is due to the demands of the national development strategy or to the real needs of the school itself. 2020 (Jung and Jo)

Massive MIMO, Ultra-Dense Networking (UDN), full-spectrum access, new multiple access, new multicarrier, and terminal direct connection are some of the key technologies adopted by 5G. Thesetechnologies work together to create a powerful basic bearer network with the qualities of low latency, high reliability, and large throughput. They also provide the foundational network supportfor the Internet of Everything. The fusion of IoT and 5G network specifically has the following Advantages: -

- **High speed:** 5G has a large capacity, and every smart device can be directly connected toa 5G base station. It makes the transfer rate greatly accelerated
- **Convenience**: 5G-based network deployment and optimization can utilize existing cabling without requiring large-scale demolition and construction, making the implementation process more convenient. On the other hand, 5G uses millimeter-wave communication to reduce the size of communication equipment, and the exchange of information between equipment is more convenient.
- **Economy:** IoT devices are directly connected to 5G mobile phones through the network, reducing the use and cost of devices such as ZigBee, routers, and switches
- **Safety**: 5G has the authentication and encryption technology, which can effectively improve the stability and security of data transmission on the basis of improving the communication speed

The use of 5G and IoT for e-learning in institutions, however, is still in its infancy, according to studies, and there aren't many articles that specifically address it (Sani, 2019). The adoption of IoTin underdeveloped nations is hindered by a lack of E-Learning, according to recent academic literature. Most researchers in the previous studies had simply considered technological concerns.Therefore, elements such as the individual, organizational, and environmental ones are crucial in the adoption of new technology. As a result, the researcher believes that Saudi Arabian HEIs mustimplement IoT in order to benefit from better chances.

The majority of developing nations have changed their educational systems. New requirements arealso necessary to build effective teaching and learning strategies within each set-up's potential constraints. In order to address and enable innovative outcomes in teaching and learning, such as the inverted classroom, Massive Open Online Courses (MOOCs), and smart learning, technology is becoming increasingly important. Figure 1 illustrates how the learning

revolution has been divided into four categories: traditional, digital, e-learning, and smart learning.

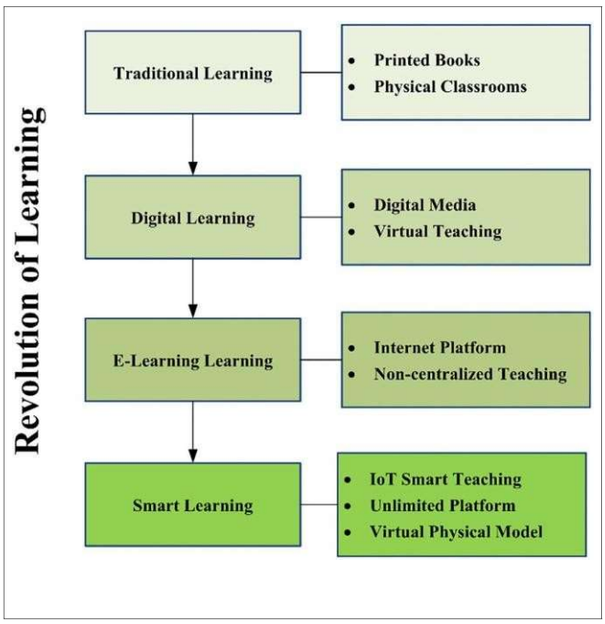

Figure 1; Revolution of learning domain

We are currently in the era of smart learning. Simply said, smart learning is the fusion of IoT with e-learning, also referred to as IoT based e-learning. In IoT-based e-learning, students use a varietyof IoT internet resources to learn at their place of study or at home. Similar to this, instructors deliver lectures through a variety of videos, meeting websites, and apps, while also scheduling tests online using the Internet of Things or smart devices. In these virtual meetings or online courses, students experience the spirit of physical classes (Kumar Basak et al., 2018). Clearly, theeffects of smart learning or IoT-based e-learning improve students' achievement, knowledge, learning and results

Modern society has completely digitalized everything; thus, the educational system has not yet adopted the most recent IoT innovations. The modernization of the educational system has advanced through numerous stages, from conventional learning to smart learning with e-learningand a 5G network. It is now time for them to be adopted in college e-learning. In IoT-based E-

Learning, students can learn effectively, and teachers can do so without difficulty, just as they would in a regular classroom. In addition to having simple access to all course-related technology, users will also have a user-friendly interface that will allow them to finish their test, quiz, or exam online and have the system grade it for them. The system will also keep track of their attendance. Most importantly, IoT-based eLearning can offer a sufficient education system for upcoming generations following the COVID epidemic. To do this, we review, dissect, and

contrast the various studies that have been conducted that are pertinent to the adoption of IoT-based E-Learning.
Additionally, it identifies the facilities needed and the influencing factors thatmust be taken into consideration in order to successfully implement an IoT-based E-Learning system in institutions. In addition, as shown in Figure 2 below, improving the transmission reliability, lowering latency, and optimizing the mobile communication network are some of themajor problems that must be resolved immediately in the development of 5G.

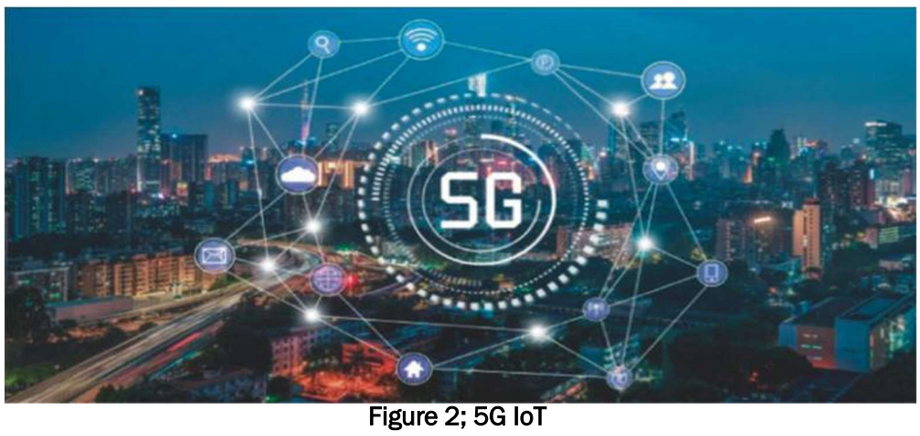

Figure 2; 5G IoT

In general, new opportunities and difficulties have been introduced to the initial information platform with the increasing growth of network and information technology, particularly the development of Internet of things and mobile platform technology. Additionally, it gives institutions additional technological opportunities to use these tools to support teaching and research. This article highlighted the effects of these welcome technologies in the learning system,despite the fact that there are many perceived set of disadvantages associated with the adoption of these technologies in the enhancement of learning settings. Additionally, it emphasized the negative effects that this adoption will have both now and in the future.

2. LITERATURE REVIEW

5G Network Architecture

Two major components of 5G are discussed below in brief. More details can be found in and frommany other resources available on the web

- **Radio Access Network (RAN):** Small cells, mega cells, towers, in-building and street-side hotspots, and many more will make up the RAN in 5G. Its function is to make it possible for mobile devices to connect to the central core. The larger area-covering 5G macro cell has gNodeB base stations with innovative radio technology. The new radio in 5G is an improved LTE radio that can sustain substantially greater data rates and is also software customizable. It is still based on OFDM, though. In 5G networks, an unique ideacalled tiny cells has been introduced in order to provide a constant connection. The new millimeter wave (mmWave) frequencies are used by small cells, which have miniature basestations. As a result, their coverage area is substantially

less and their connection range is relatively limited (usually 10 m). However, they are dispersed in groups to support the macro cells.

- The MIMO (Multiple Input, Multiple Output, also known as massive MIMO) antennas usedin the new radio technology of 5G Macro cells include many different connections or parts so that they may operate in full-duplex mode. Because of this, the system is very scalable and can handle more users concurrently.
- **The Core Network:** The mobile exchange network that controls mobile voices is the 5G core, same like in earlier generations. It also houses the data network in charge of controlling internet and mobile data connections, and it has been updated to incorporate cloud-based services. It's interesting to note that the 5G core contains distributed servers dispersed across sizable geographic areas to enable local and distributed access to contentclose to the client's premises. Edge computing is also made possible by distributed servers,allowing the majority of data to be processed at the client end without clogging the core network.

The 5G core also manages two other crucial features: network slicing and network function virtualization. On top of the same physical network infrastructure, numerous independent virtualized logical networks can be built via network slicing. After that, network slices canbe specifically assigned to a user or an application. Orchestration is used to choose resources to meet service demands in the best possible way (Ordonez-Lucena et al, 2017).The orchestration processes validate user-specific service demand and configure resources.Depending on the requirements of the application, each user receives a specific set of network resources and topology. Network slicing is essential for enabling extensive IoT connectivity.

On the other hand, network function virtualization decouples network functions such as domain name services, encryption or firewall running on dedicated networking elements in customer premises and moves the functions to run on virtual servers in the cloud. Conceptual Model Hinadawi 2022 used the structure of future English classrooms, which will be built on AI and use5G and IoT devices as the subject matter, as a case study. The strategies for implementing organized, academic English education in universities and a sophisticated learning environment were the most crucial step. In the next five to seven years, the number of intellectual classroom education platforms is anticipated to increase. An overview of the network education system's requirements analysis, performance assessment, and practical design is then given in light of the system's 5G network. A schematic representation of the suggested strategy is shown in Figure 3.

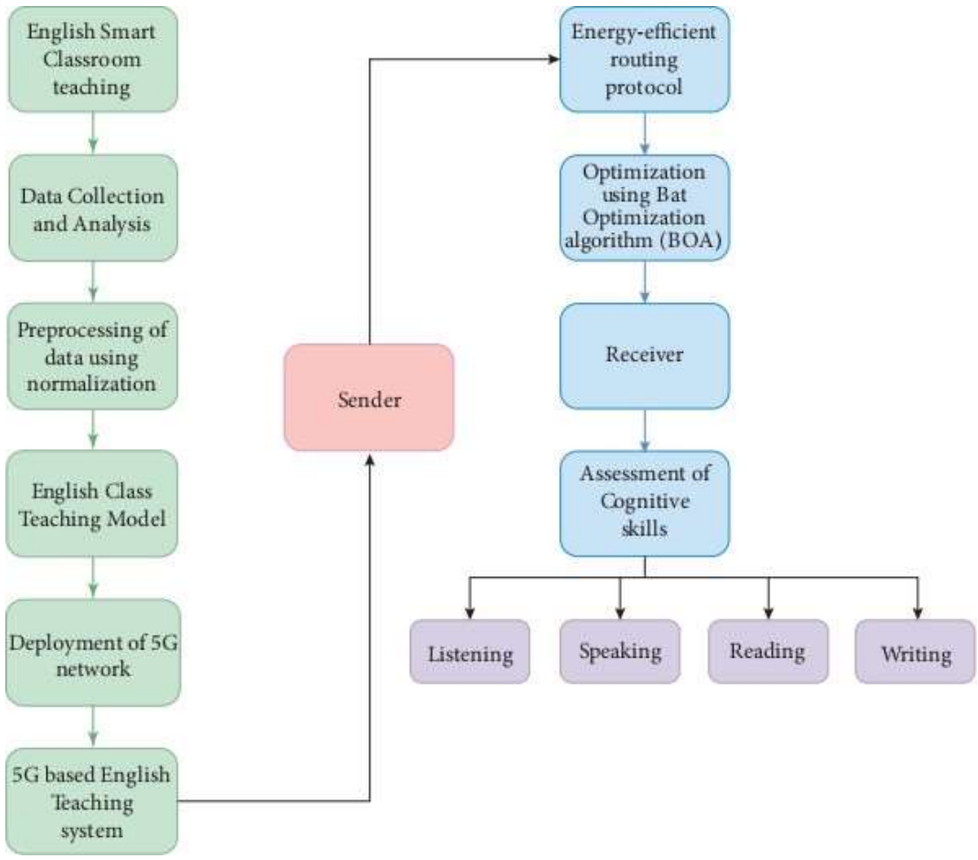

Fig 3: Framework of the proposed Model

A database of English language learners was used to collect data for the study. The study's main resource was a database that was accessible online at ttps://unimelb.libguides.com/2ndlanguage/databases.

However, there could be a duplicate packetin the dataset, and some packets could be missing. In the cleaning and preparing stage, redundantor duplicate data as well as missing data are often discarded. Sampling techniques are utilized since there is a lot of data in the educational systems. In order to select the most valuable data setand eliminate the unneeded ones, this study employed a normalization procedure technique. The size and variation of the data can be kept constant while the data set can be managed. The normalized data are used in the subsequent stages of the study For the network implantation in the study an investigation is made towards a 5G wireless networkdesign where all sensor nodes and gateways are arbitrarily distributed and made fixed after use.

The sensor nodes are assigned to each gateway if the sensor nodes' contact is within the gateway's contact range. As a consequence, sensor nodes may be allocated to prefixed gateways. Between sensor nodes, a minimum number of portals are deployed. As a result, each SN has a unique selection of portals. The DSR research plan divides data collection into phases, but rounds are alsoused to organize the process. Both sensor nodes gather data from the local area after each cycle and transmitted it to the relevant gateway. As a result, the data gates use another CH as a next-hoprelay node to remove redundant and uncorrelated data before sending it to the base station. The two nodes disconnect from the network after turning off their energy-saving radios twice. Through5G WiFi, everyone has access to the internet. Two nodes are still wirelessly connected even thoughthey are close to one another. The Bat Optimization Algorithm (BOA) method was applied throughout the investigation as the optimization technique.

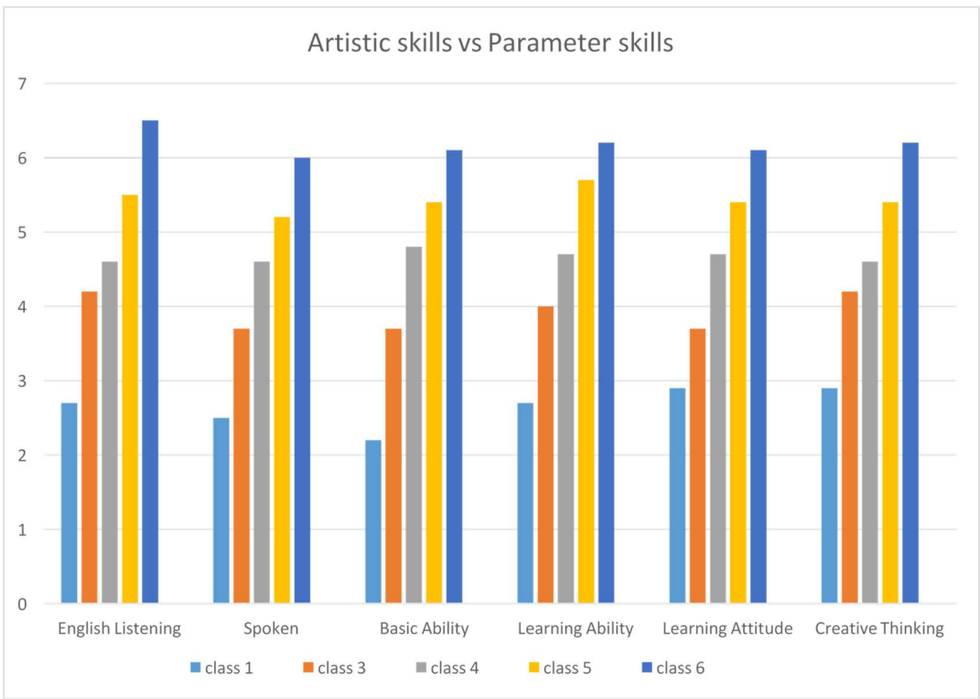

Figure 4; Artistic skills vs. Parameter skills

Building an English educational system as a first point is required to conduct in-depth conversations about 5G networks and the 5 G-based educational system. For the English information system based on the 5Geducation network to function correctly, an intelligent classroom education information transmission system must be developed. The ability of students in six classrooms to express themselves artistically after the use of 5G communication systems inEnglish learning is shown in Figure 4.

It is clear from the data analysis that the participants'English proficiency has increased to a considerable extent in terms of learning, speaking, listening,and critical thought. The impact of education delivered over 5G Internet is significantly greater than that of conventional face-to-face instruction. Distance learning powered by 5G computing is50% more affordable and has double the impact of traditional educational methods.

Figure 5 below demonstrates how much students' English language abilities advance, suggesting that 5G-based online training may be superior to the conventional physical learning approach. It was discovered that the improvement shown in subsequent physical classes lagged behind the overall improvement in student performance following 5G-based training.

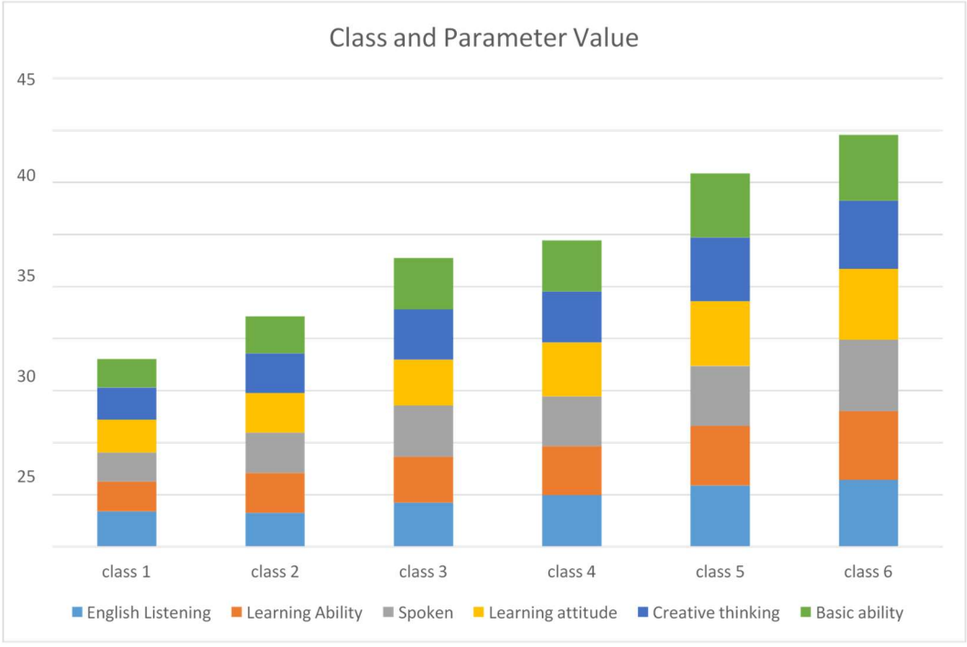

Figure 5: How Much Students' English Language Abilities Advance

In a similar vein, IoT presents outstanding prospects and achievements across a variety of fields, including the fields of science, technology, engineering, and mathematics (STEM) Such as physical computing and computer programming. It is simple to envision how IoT capabilities could be applied to robotics, STEM fields, and other areas involving the collection of precise data. Everything depends on the IoT's potential. The disruptive impact of technology on today's educational institutions has transformed education from a knowledge-transfer approach to an active collaborative self-directed model. Numerous institutions have been compelled to reconsidertheir approaches to teaching and learning as a result. The use of IoT in education is divided into four categories, including energy management, real- time ecosystem monitoring, student healthcare monitoring, access control in the classroom, and increasing teaching and learning.

A research model was put up by Hlaing et al. in 2019 to demonstrate how the Internet of Things (IoT) altered the education business model and introducednew value propositions in businesses built on the Canvas business model. Many facets of education have been affected by IoT's contribution to technologically effective learning, from student participation in the learning process and content creation to supporting teachers in creating individualized lesson plans and raising student achievement levels. IoT, a branch of Internet Technology, has been discovered to benefit education in a variety of ways.IoT solutions make it easier for educational institutions to gather enormous amounts of data fromsensors and wearable gadgets and to take action based on that data. These systems enable studentsto use embedded sensors, QR codes, and other technologies to explore an environment. They get 24/7 access to educational resources and other information. In order to enhance teaching and learning, teachers can also use smartphones and wearable technology in the classroom (Marti et al, 2017)

The Internet of Things (IoT) improves education itself and adds advanced technology to the physical environment and systems, which is one of the cleverest features of modern classrooms and universities. A clever college has the resources that make it easier for students to get to knowone another personally. The campus's smart devices use the wi-fi network to send and receive dataand orders. A computational internet of things device for academic institutions allows for the development of smarter lesson plans, the monitoring of vital resources, the improvement of admission records, the construction of safer campuses, and many other benefits.

In the modern era, students use a very sophisticated platform that includes smart boards. With theuse of online displays and movies, it makes it easier for the lecturers to explain the lectures more easily. Interactive gaming is promoted by students as a useful platform. Tools and programs that are web-based assist in educating students more effectively than those that were formerly paper- or chalkboard-based. Teachers and students can browse the internet or even edit videos and sharehomework thanks to clever technology (Hlaing et al, 2019)
Relevant Works

Building a great classroom teaching quality evaluation system and performing regular unbiased, scientific evaluations of instructors' teaching effectiveness are essential for improving the school'soverall teaching quality assessment system. Cheng et al. 2021 used the B/S design pattern with theSSM architecture and database development to produce such a solution. The system's main duty is to evaluate how well students are receiving the online course instructors' quality of instruction.Mobile learning and smartphones were used by Xu 2019 to present an overview of the idea and features of mobile learning and smartphones as well as the underlying theory and technology for mobile learning. Furthermore, a cutting-edge method of English training was created as a result ofthe growth of mobile Internet.

The theoretical underpinnings and practical implications of mobilelearning were further upon by Zhang and Bi in 2018. A theoretical framework based on computer-aided design (CAD) could promote mobile learning in English while also improving the caliber of instruction. Jiao 2021 employed a mobile edge- based paradigm to teach students English. Because of situational network and cognition framework, informal learning theory, and cognitive flexibility theory, edge computing and network architecture were included.

A "listening, reading, and hearing"-based mobile English teaching methodology was suggested. To provide composition resources and achieve compositionresource recommendation accuracy, Huang and Mai 2021 developed a learner and teacher- centered model, incorporated a suspicious degree upgrade model into the interest model, and used a machine learning technique called deep learning network algorithm. A system structure is presented that determines how each of its functional modules are implemented, and it is based onreal-world requirements. Using English writing and communication technologies based on 5G networks, Chen 2021 improved students' performance. In a networked learning environment, Wang 2021 adopted a dynamic method of mechanical manufacturing training. Before deciding on the essential technology for a network teaching environment, they studied important topics like the method for building a virtual network platform and the guiding principles of virtual reality technology.

Chen and Wang 2021 explained how network multimedia courseware may be used incollege basketball education. They begin by developing a multimedia courseware teaching plan that includes teacher supervision, student learning, and multimedia instructional materials. Second, the Flash mx2004 plug-in was employed to complete course materials of multimedia teaching basketball principles. Mo and Yan 2021 looked into how higher professional college students canexpand their abilities to study English independently, with an emphasis on informatization, to stimulate bilateral communication between students and teachers, promote students' consciousness of lifetime learning, increase teachers' technical skills, and advance a connotative system in higher professional schools. In Dou 2021, the usage of wearable technology is examined, including potential applications for English instruction in a college setting. In this study, information from teachers and students was gathered via a questionnaire. The study's findings suggest that wearable technology might spark students' interest in college English. The purpose ofthe following study is to widen the research area and maintain some of the vigor of multimodal discourse analysis by conducting an interdisciplinary investigation on multimodal semiotics and human educational practices.

Regardless of skill level, teaching English as a second language is challenging for everyone. The importance and difficulty of teaching and mastering the language increase greatly in locations where English is only spoken seldom. It is intended to increase the effectiveness of English education in universities while also enhancing students' knowledge of other academic fields by using 5G mobile internet-based training. Research Square previously published a preprint.

3. ANALYSIS AND FINDINGS

According to El-Ahmed 2022, the recent coronavirus pandemic has presented significant challenges to numerous industries all across the world. The high death toll and healthcare services'incapacity to increase their resources in time to deal with the fast-worsening crisis have brought the health sector to public attention. The pandemic examined how prepared different industries were for a sudden catastrophe in the background. The obvious response was that no one was at allready for the unexpectedly disastrous effects of the sanitary events. Instead, the time has been characterized by innovation, upgrading, learning, and experimentation—a cycle that has continuedeven as the pandemic's effects have subsided. The educational sector was particularly hard hit by the pandemic. Millions of students were abruptly forced out of the

classroom and left without a clear strategy on how to carry out their curriculum. Technology and over-the-top (OTT) programslike Zoom, Microsoft Teams, WebEx, and Google Meet were the first and most obvious option. Online learning platforms reduced the strain on the educational system, but they also made clear how inadequate the current telecom infrastructure is to handle a significant increase in the numberof users while maintaining a minimum level of service. Even in the midst of the epidemic, operators worked hard to upgrade their infrastructure, but 5G and IoT adoption cases have emergedas lifesavers for the education sector. Not only this, but the pandemic also coincided with a worldlydrive to deploy the latest technology on top of the existing 4G network

Why 5G Can Be the Difference-Maker in Education? Three main keywords favor the ranking of 5G as a difference-maker in the education sector: bandwidth, latency, and security. The new wireless standard was designed to be flexible in terms of deployment tactics, operational bands, and customization of the virtualized services used. Additionally, the most recent generation of mobile communications has significantly increased the enforcement of security standards. Since telecommunications play a crucial role in education, 5G may be the answer to some of the problems with the delivery of educational content. As a simple illustration, low 5G bands can be used to guarantee coverage and education for the majority of students, while higher bands can beused in some locations to enhance the digital experience and bring education as close to the physical one as possible.

Although 5G and IoT have applications in education that go beyond communication service provision, they could secure the necessary infrastructure for an adequate educational experience. Advanced transmission capabilities, enhanced security, and expanding edge computingavailability open up new opportunities to enhance the educational process. The inclusion of artificial intelligence (AI) and extended reality in the learning process is probablythe most talked-about feature. AI in education enables smart material, personalized learning experiences, and improved class administration, bringing schools into the digital age. The use of speech recognition technology can improve learning.

The fundamental drawbacks of distance learning, practical work, can be addressed by using extended reality, including virtual and augmented reality. While the majority of learning objectives can be accomplished through the transmission of relevant information, practical work, such as laboratory experiments and in-class projects, is challenging to deliver because the necessary toolsand resources are only available on the school's grounds. With augmented reality, a student can interact with objects in the classroom and operate equipment in ways they couldn't do with conventional online learning systems.

Additionally offering the student an immersive learning environment is extended reality. The student can be immersed in a real classroom experience where he can interact with his classmates, school/university instructor, and other classroom components, avoiding the psychological effectsof spending long hours alone in front of a computer screen.

5. ADOPTED METHODOLOGY

The sections if these papers were written from numerous up to date literature researches and studiescarried out on similar context. This involves collection and citation of relevant data
Major Concerns

1) Security challenges of 5G

5G-based educational systems are also susceptible to the standard cyber security risks that endanger any online service. Numerous attacks, including ransomware, have been recorded on various organizations worldwide during the most recent pandemic. Although these assaults are not necessarily intrinsic to 5G networks, they are significant aspects that need to be taken into account.One answer could be the emerging use of 5G private networking, which would allow institutions to deploy their networks with specific dependability and security guidelines. The spread of education based on 5G technology may also have a negative impact by escalating global inequality. The availability or not of 5G services in a particular country would then determine the standard of schooling. Finally, using 5G for educational purposes shouldn't be accepted as standard practice. What is true for a nation and the educational institution therein maynot always be true in another setting.

2) Security Challenges of IoT

Massive numbers of heterogeneous devices connected to the internet present major security risks and make it challenging to install security measures on a large scale. IoT devices are susceptible to well-known assaults such DoS and disruption attacks, MITM attacks, password cracking, and DoS attacks. Attackers who attempt to obtain and modify data by accessing sensors may target IoT sensors in spoofing, replay, and system capture assaults. The privacy of many connected devices is at risk because communication channels can be exploited using sniffer and tampering techniques, and information and traffic may be hijacked. Due to incompatibility between transmitter and receiver devices' data rate capabilities, real-time data transfer among heterogeneous IoT devices may experience congestion (Javid et al., 2080). Due to the variety of connected devices and the absence of an adequate security infrastructure, private data is not safeguarded. IoT devices face additional security risks because user data plane lacks cryptographicintegrity protection (Shah et al, 2020). Due to the rapid expansion of IoT devices, DDoS attacks will become much more common and destructive (Fonyi 2020)

- Although the IoT and 5G networks provide a variety of security risks, most nations hardlyhave the resources necessary to combat them. It has already been observed that these nations are unable to address security breaches in other industries. As an illustration, the Bangladesh Bank Cyber Heist, a 2016 bank robbery, is a good illustration of a cyberattackthat remained unnoticed. Security hackers fraudulently transferred $101 million from Bangladesh Bank during this attack. This type of occurrence obviously calls into questionknowledge of how to handle sophisticated security breaches of 5G networks and IoT devices. The following main factors paint a picture of ineffective defense against sophisticated security threats.
- **Lack of security experts:** some least developed countries s have a large void in number of skilled workforces as their education systems are not sufficiently funded to produce such (Rahman et al, 2019). In 2012, the total public expenditure on education in developed countries was approximately 5.98 percent of GDP whereas in

LDCs, the percentage was only 3.6 percent of GDP (Rahman et al, 2019). In affluent nations, this expenditure rose to 7.16 percent in 2016, whereas in least developed nations, it stayed about the same at 3.81 percent (Rahman et al, 2019). With such a low investment in education, it is impossible to develop skilled security and IT professionals, making the maintenance of emergingtechnologies similar to the 5G network even more difficult. To a greater extent, the governments' inadequate investment in personnel training and minimal expenditure in research and development (R&D) are also to blame. There is no replacement for trained security experts when it comes to handling the security problems posed by 5G. ImportingIT professionals and skilled workers is never affordable or sustainable.

- **Lack of strong infrastructure**: Along with expertise, a strong legal and regulatory framework is needed to defend the 5G network from security threats. Having inadequate hardware and tools might make it difficult to build intricate and secure network architectures. LDCs cannot even invest enough due to financial limitations to import high-end security equipment.
- **Poor funding in research and development:** Sector-specific Research and Development(R&D) programs are absent in LDCs. Less than one percent of GDP is spent by the government on R&D in LDCs (Rahman et al, 2019). Because of this, they are unable to produce their own software and hardware and must instead constantly import it from othercountries. They lack the specialized expertise and abilities needed to handle the security challenges posed by these external instruments.
- **Missing security education:** Sector-specific Research and Development (R&D) programs are absent in LDCs. Less than one percent of GDP is spent by the government on R&D inLDCs (Rahman et al, 2019). Because of this, they are unable to produce their own softwareand hardware and must instead constantly import it from other countries. They lack the specialized expertise and abilities needed to handle the security challenges posed by theseexternal instruments. According to (Catota et al., 2019), students tend to steer clear of thesecourses because they are optional at the majority of universities in Ecuador, a moderately developed nation, where 30 percent of university academic curricula offer no course on cyber security, 50 percent offer one course, and only 20 percent offer two. As a result, LDCs are unable to provide enough skilled labor to stop security attacks on a country's crucial infrastructure, such as its 5G network.
- **Resistance to changes**: Tauray et al.(year) did an empirical study on the Gambia, one of the LDCs, and found 43 ICT hurdles there. The authors contend that a major barrier to the adoption of any new technology in any nation is people's inherent resistance to change andreluctance to adopt new technologies. Mushfoq Mobarak, a development economist at YaleSOM, identified three major obstacles that have the greatest impact on how well poor countries adopt new technology: information failure, cost, and risk aversion. People have a hard time seeing the benefits of adopting ICT, so they are hesitant to adopt new technologies, claims Richardson, who based his study on the technology adoption scenarioof Cambodia, a least developed country. It won't be all that different setting up 5G in LDCs,where more than 75% of people still live in poverty.

5. CONCLUSION

Internet of Things and 5G Network has become a significant technology in ensuring the attainmentof the needs of educators and educated learners. This helps in improving the quality of education in both high and least developing countries in the world. The merger of these two highly influencedtechnical achievements made it easy for educationist and students to transform learning in difficultbasis and categories. It will therefore be recommended that many researches should be carried outto improve the efficiency of IoT based devices used in learning system

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